

A FURTHER NOTE ON INTERSCAPULO-THORACIC AMPUTATIONS.¹

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THIS month, three years ago, I had the honor of showing a case of interscapulo-thoracic amputation before the Philadelphia Academy of Surgery, and of detailing a new method of technique for its accomplishment (*ANNALS OF SURGERY*, August, 1899). At that time I had absolute confidence in the safety of the method, and the belief that no serious accidents could occur during the performance of the operation. To-day, my confidence in the method is still unshaken, provided it is carried out with good judgment, but errors of judgment may bring about complications of the most serious character. It is for the purpose of detailing my own errors in this line that I again bring up the subject.

The safety of this operation for malignant disease lies in the control of hæmorrhage, particularly of the venous bleeding, for in some cases the venous channels exposed are as large as the ascending cava. For the purpose of exposing these veins as thoroughly as possible, I have advised the disarticulation of the sternal end of the clavicle instead of a resection of that bone. When the veins are of normal size, the operation may perhaps be performed safely by either method; but when the veins are enormously increased in size, the greatest exposure of the part gives none too much room for their ligation. It was at this point of the operation in the following case that I erred in judgment, and my errors nearly cost the patient his life.

¹ Read before the Philadelphia Academy of Surgery, May 5, 1902.

T. D., aged eighteen years, white, school-boy, born in Philadelphia, was admitted to the Pennsylvania Hospital, April 2, 1902. Family history negative. He has always been quite healthy, though never very robust.

Present Condition.—One year ago, while at school, he was frequently pummelled on the right arm by some of the boys, causing a feeling of soreness for several days. During the summer, while playing baseball, he noticed that he could not throw as far as formerly, and as time went on his ability to throw a ball diminished. In October he noticed a stiffness of the arm, with a tendency to flexion at the elbow, with slight pain on motion. Not until January was he aware that the arm was increasing in size. This enlargement was at first gradual and painless, and the flexion at the elbow increased slowly until two weeks before admission, when very rapid growth set in, accompanied by severe pain, especially at night, and a feeling of discomfort and distress from the weight and bulk of the arm, which rendered the limb useless and overbalanced him when moving about.

On admission the patient was pale, very slightly built, weighing 118 pounds; eyes prominent; temperature and respiration normal, but cardiac action much accelerated, pulse ranging from 120 to 130; no murmurs present. Lungs, other organs, and urine negative to examination. Blood count: red blood-corpuscles, 5,136,000; white corpuscles, 12,400; hæmoglobin, 87 per cent. The prominent eyes with rapid heart action were strongly suggestive of exophthalmic goitre.

The right arm reveals a growth about the size and shape of a large ham. (Figs. 1 and 2.) The tumor seems limited to the confines of the humerus, as the forearm, shoulder, and axilla are not visibly affected. Axillary glands not enlarged. The growth is hard and tense, and the skin over it brawny and markedly striated. The elbow is flexed almost to a right angle and cannot be extended. Movements of the hand and fingers on the affected side are limited, with a very pronounced wrist-drop, and a weak radial pulse.

Measurements.—Circumference: Right elbow, twelve and one-half inches; left elbow, nine inches. Right biceps, twenty-two inches; left biceps, eight inches. Right axilla, fifteen inches; left axilla, twelve and one-half inches.

April 24, ether administered. An incision was made through



FIG. 1.—Sarcoma of right arm, anterior view.



FIG. 2.—Same patient, side view.

the skin and superficial fascia from the sternum, along the clavicle to its middle, and then curved downward to the anterior axillary fold. The clavicle was disarticulated from the sternum with blunt, curved scissors, the rhomboid ligament and the clavicular portion of the sternomastoid muscle were divided, and the clavicular portion of the pectoralis major separated with the finger from the costal portion of that muscle up to the anterior axillary fold. The clavicle was now pulled upward and the subclavius muscle divided at the first rib. The pectoralis minor was then exposed, divided, and the coracoid portion reflected upward with the clavicle. Enormous venous channels immediately presented surrounding the anterior scalene muscle. A careful dissection revealed that the greatly enlarged cephalic vein joined the subclavian just in front of the anterior scalene muscle, and the vessel formed by this union was from an inch to an inch and a quarter in width. An attempt was made to expose the third portion of the subclavian artery or the first part of the axillary by retracting the veins, but it failed, and the vessel could not have been ligated in these positions unless the great venous channels had first been dealt with and severed. If the artery was to be secured first, and the blood in the arm saved to the patient, it seemed to me necessary to pass the ligature at about the junction of the first and second portion of the subclavian. This was done, and the vessel firmly secured with a chromicized catgut ligature, but unfortunately the pleura was also opened. In the presence of such enormous veins, which were now very turgid and flaccid with every inspiration and expiration, the noise of the air rushing in and out of the pleura was most alarming and terrifying, resembling my ideas of the sound of air entering a vein. A gauze sponge was packed deeply in the cavity over the pleural rent, the arm was elevated, and ligatures were passed around the veins,—one around the subclavian at a point which corresponded to the first portion of the artery, one at its distal portion before it had been joined by the cephalic, and one around the cephalic. These ligatures were tied when the arm had become fairly well blanched, and the vessels, together with a part of the brachial plexus of nerves, were divided. The ligature around the cephalic vein slipped and the wound was instantly flooded with blood. The hæmorrhage was quickly stopped with the finger and the vessel secured with two hæmostatic forceps and ligated. While dividing

the remainder of the brachial plexus of nerves, another large vein was opened, which produced a very alarming hæmorrhage. This was also controlled by direct pressure, and the vessel secured with hæmostatic forceps and ligated. It proved to be a large communicating branch from the cephalic to the jugular vein. These two hæmorrhages occurring with such a short interval between, and with the loss of several ounces of blood in a few seconds, rendered the condition of the patient most precarious. He was almost pulseless, and respiration was shallow and irregular. Hypodermics of strychnine and digitalin were given, while an assistant opened a vein in the left leg and introduced two quarts of hot normal salt solution. During these procedures the rent in the pleura was stitched up with catgut, the patient turned on his left side, and an incision dropped to the lower angle of the scapula and up to the anterior axillary fold. The scapula was rapidly freed from its attachments, and the two skin incisions joined through the axilla, completing the detachment of the upper extremity. Three or four vessels required a ligature. The wound was closed with silkworm gut, a rubber drainage tube coming out at the lower angle, and at the sternal angle a wick of gauze led down to the pleural rent. The time of operation was fifty-five minutes, and the patient's condition at the close was fairly good.

For a week following the operation the patient's temperature ranged from 99° to 101° F., the pulse-rate from 110 to 140, the cardiac action being accelerated under the slightest exertion. On the third day the gauze wick and the drainage tube were removed, and on the ninth the stitches were taken out, and the wound found in excellent condition, with good union. At both these dressings there was evidence of a right-sided pneumothorax of slight degree, the expansion of the chest being about equal on both sides, and the heart in its normal position. Dr. Frederick A. Packard very kindly saw the patient with me, and concurred in the belief that Graves's disease was also present. For these reasons the patient has been kept quiet in bed, and will now be placed on small doses of suprarenal gland. Dr. Longcope, the resident pathologist of the hospital, has kindly furnished me with the following notes of the tumor.

Report of Pathologist, No. 5335.—The specimen consists of the entire right arm amputated with scapula and clavicle attached. The upper arm

presents an enormous fusiform swelling reaching from the head of the humerus to the elbows. The arm weighs 7000 grammes. The skin over the swelling is discolored bluish, and there is a streaking somewhat similar to the *lineæ atrophicæ* of the abdomen. The elbow-joint is slightly swollen, but the forearm and hand appear normal. The swelling is hard and firm. On section, the tumor is found to be an enormous growth, arising evidently from the periosteum of the humerus. It is fusiform in shape, and reaches its greatest thickness about the middle of the humerus, where it surrounds the bone in a collar 8.5 centimetres in thickness, being separated from the skin only by the superficial fascia and subcutaneous fat. The growth is generally firm, pearly white, and slightly translucent, having an irregular outline, which in some places is fairly well circumscribed, but in others appears to infiltrate between the muscle bundles.

Large ragged cavities occur throughout, often measuring 4.5 or seven centimetres in diameter, and being filled with a clear yellow fluid. A portion of the free surface of the bone forms the wall of one of these cavities. The bone is covered with small, soft, tooth-like elevations which project like the quills of a porcupine. Some of them are calcified. Near the elbow much of the growth above the bone contains areas of calcification. At the upper end the growth has broken through the capsule into the elbow-joint and forms a lobulated, firm, gray mass near the head of the humerus.

Both the subcutaneous tissue and muscles are greatly œdematous, the muscles being exceedingly pale and streaked. They are all so compressed by the growth that the various groups of muscles cannot be distinguished. The branches of the brachial plexus are compressed by the growth, and the musculospiral nerve is lost entirely in the tumor mass. The vessels are clear. The axillary glands are enlarged, often the size of beans, œdematous, and soft. No macroscopic areas of growth are found in them. The growth does not involve the clavicle or scapula. The subscapular muscle is unaffected.

Section through the newer portion of the growth, which is invading muscle, shows it to be composed of large, irregular, and round cells grouped in a somewhat ill-defined alveolar arrangement. These alveoli are only distinguished by a fine stroma or single capillary which runs between them. A very fine net-work of stroma is likewise visible between the individual cells. The tumor cells are irregularly round or polygonal and vary somewhat in size. The nuclei are even more irregular than the cells; usually, they are oval or round and vesicular, the nucleoli being distinct, but frequently picknosis is present, or the nuclei are very large and pale. Both karyolysis and karyokinesis are common, and here and there a large multinucleated cell is seen.

In the older portions of the growth extensive degeneration has taken place; here the tumor cells are confined to areas about the blood-vessels, and both cytoplasm and nuclei show great irregularity in size and staining qualities. Some cells assume an elongated shape; others are very large and multinucleated, and the protoplasm contains large numbers of fat droplets or is vacuolated. The muscle surrounding the tumor is the seat

of an extensive interstitial myositis, large areas of muscle have undergone degeneration, and show slight infiltration of small round cells, epithelioid, and young connective-tissue cells. The muscle cells lying in small areas between the degenerated portions are very small, irregular, and often broken. Their nuclei are greatly increased in number, and the striations are usually lacking.

The lymph glands from the axilla show an endothelioid proliferation with enlarged lymph channels. The keimcentra are swollen, but no tumor cells can be found.

Diagnosis.—Spindle-celled sarcoma.

To return to the technique of the operation. When the veins were exposed, and it was found impossible to ligate the third portion of the subclavian artery or the first part of the axillary, it was an error to ligate the subclavian at the junction of the first and second portions. Owing to its depth, its close relation to the pleura, its partial covering by the vein, and the close proximity of the phrenic nerve, such a ligation will always be attended by an immediate danger to these important structures. Secondly, the short distance from the innominate, together with the large branches given off in its first portion, subjects the patient to the remote danger of a secondary hæmorrhage, an event which would almost of necessity mean death. The ligation of this portion of the subclavian artery was therefore a distinct error in judgment, and led to serious complications.

Two other procedures were open to me, either of which would have been safe. First, the veins could have been ligated first, and after they had been severed the artery would have been readily exposed. This would have lost to the patient the amount of blood that remained in the arm, of some consequence, perhaps, but a much smaller risk than the one taken. Second, a still better procedure would have been to expose the axillary artery as high as possible, certainly its third portion and probably its second, and tie a temporary ligature about it. Then the arm could have been elevated, the veins ligated and severed, and a permanent ligature placed around the third part of the subclavian, and the artery severed in this portion. This could have been quickly and safely done, and would have saved to the patient the blood in the part amputated.